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SOVIET EXCAVATORS

(Excerpts)

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SOVIET EXCAVATORS

(Excerpts)

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INTRODUCTION

The quantitative and qualitative growth of Soviet excavator construction is creating favorable conditions for the widespread mechanization of labor-consuming and heavy work and loading-unloading and erection operations on construction projects.

During recent years the variety and supply of Soviet excavators has been considerably supplemented by new models of machines and the design of earlier produced excavators has been subjected to modernization.

This handbook includes a description of newly produced excavators and excavators not included in the first edition.

The types and basic parameters of single-bucket excavators are given in accordance with All-Union State Standard (GOST) 518-54 and those for multibucket excavators, according to All-Union State Standard 6434-52.

Unfortunately the indices designating the corresponding model of single-bucket excavator do not correspond to the designations used in All-Union State Standard 518-54. Each department producing excavators in its factories has provided its own designation of models.

Thus, the factories of the former Ministry of Construction and Road Machinery produced excavators designated with the codes: E -- single-bucket excavators, EM -- multibucket excavators for transverse excavation, ET -- multibucket ladder-type trench excavators, ETR -- multibucket wheel-type trench excavators.

The first two figures in the index of single-bucket excavators with a bucket capacity up to 0.99 m^3 and the first three figures for excavators with a bucket capacity over 1.0 m^3 indicate the bucket capacity in hundredths of a cubic meter.

For example, the coding for the excavators E-652 and E-6512 with bucket capacity up to 0.99 m^3 and the excavator E-1252 with bucket capacity greater than 1 m^3 is deciphered in the following way:

E-652 -- excavator with bucket capacity of 0.65 m^3 , model 2;
E-6512 -- same, but model 12;
E-1252 -- excavator with bucket capacity of 1.25 m^3 , model 2.

For multibucket excavators used in open pits and in reclamation work, the bucket capacity is indicated in liters (first two figures), while the last figure in the index is the number of the model. For example, the EM-302 is a multibucket excavator for transverse excavation with bucket capacity of 30 liters, model 2.

In trench excavators, both ladder- and wheel-types, the first two figures designate the depth of excavation in decimeters and the last figure gives the number of the model. For example, ETR-152 is a wheel (rotor)-type trench excavator, with depth of excavation 1.5 meters (15 dm), model 2.

The excavators of the former Ministry of Heavy Machinery have the codes ESh for walking excavators; the fractional number following these letters indicates: in the numerator -- the bucket capacity in m^3 , and in the denominator -- the length of the boom in meters. For example, ESh-4/40 is a walking excavator with 4 m^3 bucket capacity and boom length of 40 m. The single-bucket excavators produced by the factories of the former Ministry of Heavy Machinery and other departments are given individual codings containing abbreviated information concerning bucket capacity, the type of undercarriage, the serial number of the model, the first letter of the family name of the designer who developed the model, etc.

THE E-153 EXCAVATOR, BASED ON THE PNEUMATIC-TIRED "BELARUS" TRACTOR MTZ-2, 0.15 m^3 BUCKET CAPACITY

Purpose. The E-153 excavator is designed for handling small-scale excavation work in earth of categories I-IV inclusive on widely scattered jobs.

Because the tractor has a bulldozer blade in front, the excavator can be used for the filling of trenches and the leveling of construction sites. The excavator is used as a hoisting crane for the loading and unloading of freight.

For the needs of agriculture the excavator can be equipped with forks for manure or a bucket for mineral fertilizer or for root crops. The E-153 excavator is widely used in urban and rural construction.

In contrast to other excavators the E-153 can dig foundation pits with vertical walls. This is done by the turning of the hoe bucket while work is in progress.

The minimum possible foundation pit with vertical walls can have a cross section of 1.5 X 2 m with a depth up to 2.1 m.

The activation of the hydraulic cylinders of the boom, turntable and supports is accomplished by one plunger pump; the hydraulic cylinders of the bucket handle, bucket and bulldozer are activated by a second such pump.

The operating equipment of the excavator consists of ^{unified} ~~unitized~~ shovel and hoe, crane and bulldozer, all served by the same counter-weight.

To remount the shovel, to make it a hoe, or vice versa, it is sufficient to turn the bucket 180° and reposition the pins of the coupling rod of the hydraulic cylinders, leaving unchanged the position of the boom and handle.

For conversion to work as a crane, the bucket must be removed from its handle and replaced with a crane suspension.

The control of the excavator is accomplished by means of hydraulic distributors connected with the levers of the control panel. When operating as a bulldozer or when being transported, the operator's seat can be turned by 180°.

THE EXCAVATORS E-252 AND E-351, CRAWLER MOUNTED,
BUCKET CAPACITY 0.25 AND 0.35 m³

Purpose. The E-252 excavator is designed for excavation work in earth of categories I-III, primarily on a small-scale, during the building of canals and roads, the leveling of construction sites, the digging of trenches and foundation pits and as a crane in loading-unloading work.

The E-351 excavator is a modification of the E-252 and is designed for work in peaty and swampy areas: when digging main-line and lateral canals for the drainage of peat deposits and in the construction and cleaning of irrigation networks in agricultural lands.

The turntable is of welded construction; it and the mechanisms mounted thereon are the same in the excavators E-252 and E-351. The hoisting winch on the E-351 excavator does not have a mechanism for opening the bottom of the bucket.

rated These excavators have an undercarriage of the crawler-type, with a large amount of bearing surface. The excavator is rigidly set on bogie wheels -- six per side in the case of the E-252 and eight per side in the case of the E-351. The E-351 excavator differs from the E-252 by its longer and broader crawler treads; this decreases the specific pressure on the ground. As a result of the lengthened tread an additional intermediate transmission has been added to the crawler drive; this decreases the speed of travel of the E-351 excavator by one-half that of the E-252.

The operating equipment of the E-252 excavator consists of a general-purpose boom, bucket handle, bucket, block and tackle, hook, forward support and latticework crane boom.

The boom is general purpose in that it is used for work with both a shovel with hinged suspension of the handle and for work as a hoe.

The E-351 excavator has a clamshell bucket in addition to the operating equipment already mentioned.

When operating as a crane a general purpose boom can be used, together with an insert. In this case the total length of the boom is 6.5 meters.

Production of the E-252 and E-351 excavators was suspended in 1951 and replaced with the excavators E-257 and E-352; these two were produced up to 1956. *Terminated?*

THE EXCAVATORS E-257 AND E-352, CRAWLER-MOUNTED, 0.25 m³ BUCKET CAPACITY AND E-301 (E-258), WHEEL-MOUNTED, 0.3 (0.25) m³ BUCKET CAPACITY

The Leningrad Excavator Factory began the production of the excavators E-257 and E-352 in 1951 to replace the excavators E-252 and E-351 that had been produced earlier. That same year it began to produce the excavator E-358 as well; the latter was later redesignated the E-301 after its bucket capacity had been increased.

The excavators E-257, E-352 and E-301 have in common the turntable with its motor, all mechanisms, control devices and cab, and also unitized operating equipment in the form of shovel and hoe.

The purpose of the E-257 and E-352 crawler-mounted excavators is the same as that for the E-252 and E-351.

The E-301 excavator is designed to handle small-scale excavation work on urban, highway and agricultural construction projects and can also be used for loading-unloading work. The excavator can handle

earth in categories I-III; with different equipment it can accomplish the same work as the excavators E-252 and E-257.

The schematic diagram of the E-257 excavator differs from that of the E-252 in that a second speed for rotation of the turntable has been provided, with a reduced speed for use when operated as a crane.

The schematic drawing for the E-352 excavator differs from that for the E-257 by having an additional chain drive for the crawler unit, while the shaft of the forward winch lacks a mechanism for opening the bottom of the shovel's bucket.

The schematic diagram for the E-301 excavator is the third modification of the diagram for the E-257 excavator; two additional travel speeds have been provided for; together with the two speeds of the upper transmission, this enables the excavator to have four travel speeds.

The turntable of the excavator E-257 differs from that of the E-252 in that its body is all-cast and not welded. The lower part of the body is an oil-filled crankcase; inside the crankcase there are shafts and gear wheels for the upper track and turning mechanism. The supports for the hoisting and hauling winches are cast with the body of the turntable in a single piece.

The operating equipment of the excavators E-257, E-352 and E-301 is the same for each of them and consists of a unitized boom, the dipper handle for the shovel and hoe, a latticework boom for equipping the excavator as a dragline, clamshell and crane. Special buckets are used with the E-352 excavator: the hoe has a shaped bucket with a capacity of 0.35 m^3 , while the clamshell has a capacity of 0.75 m^3 .

No shovel equipment is provided for the E-352 excavator.

The boom and handle of the unitized equipment and the forward support are of welded construction. The bucket is also of welded construction, but the front wall is of cast metal. The teeth of the bucket are made from high-manganese steel.

The latticework boom has three inserts; these can be used to lengthen it from 7.5 to 12 m.

THE E-353 (E-255) EXCAVATOR, PNEUMATIC-TIRED, 0.35 m^3 BUCKET CAPACITY

Purpose. The E-353 excavator is designed for work in open pits for the digging of sand, clay and gravel, for loading and transfer work, for the digging of foundation pits under buildings and other structures,

and trenches for water and gas lines. The general purpose character of this excavator is insured by the presence of interchangeable operating equipment.

This excavator can handle earth of categories I-IV.

Power shovels of the class E-255, numbered from 1-1,605, were produced with a bucket capacity of 0.25 m^3 . When the bucket capacity was increased to 0.35 m^3 the code E-353 was applied to the shovel and the numbering again began with 1.

The schematic diagram of the mechanisms located on the turntable is similar to that for the E-651 (E-505A) excavator. The diagram for the running gear is similar to that for the E-301 (E-258) excavator.

Running gear. The E-353 excavator is based on a special pneumatic-tired two axle bogie. This gives it a high rate of speed either when self-propelled or when towed by YaAZ-200 and MAZ-205 trucks.

The running gear uses the rear axle of the YaAZ-200 truck and a special front axle.

Operating equipment. The E-353 excavator can be equipped with a shovel with hinged suspension of the bucket handle and a hoe; in both cases the same booms, handles and buckets are used. It can be used as a dragline with boom length of 8 or 11 meters, as a clamshell with boom length of 8 or 12 meters and as a crane with boom length of 8, 12 or 15 meters with an extension piece 5 meters long (for construction-erection work with loads up to 1 ton). In the latter case there is a supplementary worm-type winch for hoisting the boom.

A boom of latticework construction (three-dimensional truss) is used for the dragline, clamshell and crane.

The standard length of the two-part boom is 8 meters; it can be extended by inserts of 3 and 4 meters length.

Power equipment. In contrast to other excavators of this class, for example the E-301, the E-353 has a motor of considerably greater power; it carries a 54 HP tractor diesel.

Production of the E-353 excavator was suspended in 1956; it was replaced by the E-302.

THE UNITIZED EXCAVATORS E-302, E-303 AND E-304, 0.3 m³ BUCKET CAPACITY

Purpose. The general purpose excavator E-302, mounted on pneumatic tires, the crawler-mounted E-303 and the E-304 on extra-wide crawler tracks, replace the obsolete excavator models E-353, E-301, E-257 and E-352. Therefore the purpose of the new family of excavators is the same as that of the replaced models.

The excavators E-303 and E-304 have proven satisfactory in tests and are now in standard production.

The same turntable can be used with all kinds of running gear and operating equipment of this unitized family; therefore none of its mechanisms need to be changed or remounted when replacing one piece of working equipment with another.

The schematic diagram of the excavators E-302, E-303 and E-304 differ only slightly from one another -- in the number of transmission parts.

The excavator E-302, mounted on pneumatic tires, has 43 transmission parts in comparison with the 50 parts of the power transmission and 10 control gear wheels on the pneumatic-tired excavator E-301.

Operating equipment. The basic operating equipment of this family of excavators is the completely unitized shovel and hoe. In addition, the excavators are equipped with a latticework boom for work with a dragline, crane, clamshell and special erection crane with extension.

The unitized boom and handle are welded; their principal parts are made of thin curved sheet metal.

The mechanisms of the excavator are pneumatically controlled. Pneumatic friction clutches are used; their distinctive characteristic is that there is no need for adjustment during work and relative simplicity of their design.

The turning of the front wheels is controlled hydraulically (without pumps) by the steering wheel. The hubs of the wheels are connected by a Janteaux trapezium and the turning of one of the hubs causes the turning of the second hub that is necessary for movement along a curve.

The excavator has a 0-39A compressor. The pressure in the pneumatic control system is 6.5-7 kg/cm².

THE E-504, E-505 AND E-505A EXCAVATORS WITH 0.5 m³ BUCKET CAPACITY AND
THE E-651 AND E-652 EXCAVATORS WITH 0.65 m³ BUCKET CAPACITY

Purpose: The E-504, E-505, E-505A, E-651 and E-652 excavators are designed for digging in earth of categories I-IV and in finely crushed earth of categories V-VI (size of pieces no greater than 300-400 mm). It can also be used as a crane for loading-unloading work.

These excavators are very widely used in the national economy of our country. They are used in the construction of railways and highways, the building of irrigation and drainage systems for agriculture, in industrial construction and construction of housing.

The accomplishment of different kinds of work is insured by the presence of interchangeable working equipment.

The first models of these shovels were designated D-107; the excavator was later redesignated the E-505 after a KDM-46 diesel was installed and E-504 when an electric motor was installed.

As a result of continuing modernization and improvement of several units and parts, the E-505 was redesignated the E-505A.

To make use of the reserves of power of the motor and the overall strength of the excavator, the bucket capacity of the excavator was increased to 0.65 m³ and the excavator was designated the E-651 (with hydraulic control system) or E-652 (with pneumatic control system).

Despite all the modernizations and improvements to the excavator the basic schematic diagram has remained unchanged.

The basic E-652 excavator has several modifications, each of which is designated differently, for example:

E-653 -- an excavator with a shaped bucket, capacity 0.65 m³ or 1 m³. It is mounted on extra-long and extra-wide crawler treads and is designed for work on swampy sites;

E-656 -- an excavator, mounted on pneumatic tires, with travel speed up to 15 km/hr; this enables it to be used on construction projects where the work is on a small scale and where the jobs are situated at some distance from one another. This excavator has a crane with a load-lifting capacity up to 10 tons and a clamshell as interchangeable equipment; it can therefore be used for loading-unloading work.

Operating equipment. The following can be mounted on the excavator: shovel or hoe, dragline, clamshell, crane, pile driver, diesel hammer with wedges, etc. It is possible to use buckets of greater capacity -- 0.75 and 1 m³ -- for the purpose of increasing the rated capacity of this excavator in light earth.

When equipped for use as a shovel the thrust mechanism for the E-505 excavator, up to unit no. 130, was dependent; in subsequently produced units it was independent. The E-505 excavator, beginning with unit no. 3,200, and all excavators E-505A, E-651 and E-652 had a thrust mechanism that was independent or combined. There is special interchangeable working equipment for loosening frozen earth during the excavation of foundation pits in the wintertime. A C-222 diesel hammer with a 1,200 kg weight is mounted on the shovel boom.

The shovel boom and handle are of welded construction, with a box-like cross section. The boom of the dragline, clamshell and crane are also welded, but of latticework construction, a three-dimensional truss. The latticework boom can be changed in length by adding inserts of 3 or 5 meters in length.

There is hydraulic control of the basic mechanisms of the E-651 (E-505A) excavator. The oil in the hydraulic cylinders is fed under pressure by a L1F12 pump rotating counterclockwise. The pressure in the hydraulic system is 40 kg/cm².

THE E-502 EXCAVATOR, CRAWLER-MOUNTED, 0.5 m³ BUCKET CAPACITY

The E-502 excavator was produced from 1945 to 1955 and was an improved model of the LK-0.5A that had been produced until 1941; it had a M-17 motor from the tractor ChTZ-65).

Purpose. The E-502 excavator was designed for excavation work and transfer of material to a dump or into vehicles. It can handle earth up to category IV.

The presence of interchangeable equipment enables the excavator to be used for different kinds of loading-unloading work and for the erection of metal and reinforced concrete structures.

The schematic diagram of the E-502 excavator is essentially identical to that of the LK-0.5A and differs from the latter in that it does not have the friction clutch for engagement of the transmission on the end of the reversing shaft III as in the LK-0.5A. The function of this friction clutch on the E-502 is performed by the main clutch in the motor.

Operating equipment. The E-502 excavator can be supplied with one of the following kinds of equipment: shovel, hoe, dragline, crane and clamshell. The shovel boom is a simple beam with box-like cross-section; the handle is made of two beams, one on either side of the boom. The thrust mechanism is dependent on cables while the motion of the handle is governed by rack and pinion.

The dragline boom is a latticework three-dimensional truss.

THE OM-201 AND OM-202 EXCAVATORS, CRAWLER*MOUNTED, BUCKET CAPACITY 0.5 m³

The OM-202 excavator is an improved design of the OM-201.

The following are the principal improvements of the OM-202 excavator in comparison with the OM-201: the mechanism for changing the treads has been changed and independent braking of the crawler-type running gear has been introduced; a reversing gear of new design has been installed; the width of the friction and brake bands of the main winch has been increased; the wooden cab has been replaced with a metal one; there has been a change in the speed of excavator travel, of hoisting the bucket and return of the handle; the bucket and boom are of new design.

Purpose. The excavators OM-201 and OM-202 are used primarily for excavation of earth of categories I-IV.

The schematic diagram of the OM-202 shovel has remained the same as that for the OM-201, but there are small changes in the design of the reversing and travel mechanisms; the gear ratios of the hoisting-hauling winch and crawler-type running gear have been changed.

The OM-201 and OM-202 excavators are used in the same kinds of work as the E-505 and E-652, but their lever system of control enables them to be used under severe climatic conditions where the use of machines with pneumatic or hydraulic control systems is complicated by the freezing of condensed water and thickening of the oil.

Operating equipment. The following can be mounted on the OM-201 and OM-202 excavators: shovel, hoe, dragline, clamshell and crane. The booms for the shovel and hoe are welded and have a box-like cross section. The boom for the dragline, clamshell and crane is a latticework three-dimensional truss, common for all three types of interchangeable equipment.

EXCAVATORS E-751, E-752, E-753 AND E-754, CRAWLER-MOUNTED,
0.75 m³ BUCKET CAPACITY

The first model of the excavators in this group, the E-751, was produced with an electric motor. Beginning in 1950 this excavator carried a KDM-46 diesel motor and was designated the E-752. In 1951 the E-751 and E-752 were subjected to considerable modernization and were then designated the E-753 (with electric motor) or E-754 (with diesel drive).

Purpose: The E-751, E-752, E-753 and E-754 excavators are used for the mechanization of excavation work on a concentrated scale in industrial and hydraulic engineering projects, for building highways and railways, in gravel and sand pits and in rock quarries, in stripping work and when excavating inert materials.

When there is crane equipment these excavators can be used for loading-unloading work.

The schematic diagram of the E-751 and E-752 excavators, and of the E-753 and E-754 differ from one another only in the running gear.

The running gear is of the crawler type, with low specific pressure applied to the ground. The bogie consists of a cast steel frame which by means of a divided axle rests on two multishoe crawler bogies.

In the E-751 and E-752 excavators power is transmitted to the running gear through a gear drive; in the excavators E-753 and E-754 it is by roller chains made with small curved plates.

These excavators have interchangeable operating equipment; it includes a shovel, dragline, clamshell and crane.

The shovel consists of a boom of welded construction with a box-like cross section, dependent cable thrust mechanism, a two-beam bucket handle and a bucket of 0.75 m³ capacity for heavy earth and 1 m³ capacity for earth in categories I-II. The buckets are welded but the rear wall is cast and the front wall is stamped from rolled sheet metal.

The reciprocating movement of the bucket handle is accomplished by the pinion gears on the thrust shaft meshing with the racks on the bucket handle.

The boom for the dragline, clamshell and crane is sectional and of welded latticework construction. Its length can be changed by adding inserts of various lengths.

When using a boom 15 meters long it is necessary to attach a 600 kg counterweight.

The excavator is mechanically controlled by separate-action levers situated in the fore part of the cab by the operator's seat.

THE E-801 (E-756) EXCAVATOR, CRAWLER-MOUNTED, 0.8 m³ BUCKET CAPACITY

Purpose. The E-801 excavator is designed for work in open pits and on construction sites in earth up to category IV and in finely-crushed earth of categories V and VI. With crane equipment this excavator can be used in loading-unloading and construction-erector work. The new E-801 excavator replaced the E-753 and E-754 which were antiquated and taken out of production in 1956.

The schematic diagram for this excavator is basically new and differs from that for excavators produced by other factories.

The operating equipment is interchangeable and consists of a shovel, dragline, clamshell, crane and block-grappler.

The shovel boom consists of a single beam with box-like cross section and a two-beam bucket handle with indented racks.

This excavator has a general purpose thrust mechanism. With a simple readjustment it can be reset for dependent, independent or combined thrust.

A latticework boom is used for operation as a dragline, clamshell, crane or block-grappler. It is of welded construction and in two sections -- a lower and an upper. Extension pieces inserted between the sections of the boom can lengthen it from 11 to 20 meters.

The block-grappler is a massive tongs which is opened and closed in a manner similar to that of a clamshell bucket.

Blocks, logs, large waste pieces of reinforced concrete, everything that cannot be removed by an ordinary excavator bucket but whose size is within the grasp of these tongs can be easily removed by the block-grappler.

The mechanisms are pneumatically controlled. The O-16A air compressor passes air through an oil-water separator and sectional cooler at 4-5 atmospheres pressure into an air distributor situated under the control panel.

The cooler and air distributor, in addition to their immediate purpose, are also air collectors which eliminate the pulsation of air fed by the compressor and simultaneously serve as a place for the liberation of water of condensation.

The control panel and the operator's seat are situated in a separate cab which is heated in the winter time by air warmed by discharged gases from the diesel motor.

CRAWLER-MOUNTED EXCAVATORS E-1003, E-1004, 1003A AND 1004A, 1 m³ BUCKET CAPACITY AND EXCAVATORS E-1251 AND E-1252, 1.25 m³ BUCKET CAPACITY

Purpose. The E-1003, E-1004, E-1003A, E-1004A, E-1251 AND E-1252 excavators are general purpose full-turning machines, crawler-mounted, with single-motor electric or diesel drive. They are designed for work in earth of categories I-IV and in finely-broken rocky material of categories V and VI.

These excavators, equipped with a shovel or dragline, perform various excavation jobs: the stripping of minerals, the digging of foundation pits for buildings, the making of cuts and fills for railways and highways, and work associated with the construction of irrigation systems, etc.

These excavators, equipped with a crane, can be used for loading-unloading work.

The schematic diagram of all these models of excavators are identical with the exception of parts of the power equipment and the drive mechanisms of the hydraulic pump of the control system.

The first ten excavators produced were designated the E-1001. Thereafter the design of the units was subjected to considerable changes.

The excavators E-1003 and E-1004 were produced from 1949 through 1955. After modernization these excavators were designated the E-1003A and E-1004A respectively.

With an increase in the capacity of the bucket from 1 to 1.25 m³ the designation of the models was changed and they were called the E-1251 and E-1252.

The drive of the E-1003, E-1003A and E-1251 excavators is accomplished by an electric motor, while the E-1004, E-1004A and E-1252 excavators are diesel propelled.

The operating equipment consists of interchangeable sets made up of a shovel, dragline, clamshell and crane. The last three types of equipment are mounted on a latticework boom.

The shovel consists of a welded boom, thrust mechanism, bucket handle and bucket.

The thrust mechanism for the E-1003 and E-1004 excavators is of the independent chain type, while in the E-1251 and E-1252 it can be equipped in three different ways: dependent, independent and combined.

For work as a dragline, clamshell and crane the E-1251 and E-1252 use a 12.5 meter boom instead of the 13 meter boom used for the E-1003 and E-1004. The boom can be lengthened by inserts of 2.5, 5 and 10 meters length.

The load-lifting capacity of the crane in the E-1251 and E-1252 has been increased from 15 to 20 tons, the lowering of the load and hook have been correlated with the regime of the motor. The maximum length of the boom has been increased from 23 to 30 meters and an extension piece, 5 meters in length, has been provided.

The power equipment on the E-1251 (E-1003A) excavator consists of a three-phase short-circuited motor MA-14B-2/4, alternating current, 85 kw, 1,480 rpm, 380/220 volts.

The E-1252 (E-1004A) excavator has a high-speed diesel motor 2D6 (without compressor) equipped with a ST-710 starter. Four 6-ST-128 storage batteries are used for starting; they are coupled, series-parallel, to produce a voltage of 24 v in the system.

EXCAVATORS E-2001 AND E-1001, CRAWLER-MOUNTED, 2 m³ BUCKET CAPACITY

Purpose. The E-2001 and E-2002 excavators are designed for the accomplishment of mechanized excavation work on a large scale on industrial, hydraulic engineering and road construction projects.

With crane equipment this excavator can be used for various kinds of loading-unloading work.

Operating equipment. These excavators are produced with three kinds of interchangeable operating equipment: shovel, dragline and crane.

The shovel consists of a welded boom of box-like cross section, independent chain thrust mechanism, bucket handle and bucket.

A 2 m³ bucket is used for handling heavy earth; a 2.5 m³ bucket for medium earth; a 3 m³ bucket for light earth.

The thrust mechanism consists of a pressure shaft, the sprockets for the chain drive, two cylindrical notched gear wheels, two racks, saddle brackets and bearings.

The shovel's bucket handle is of welded construction. It consists of two beams.

The dragline consists of a welded latticework boom, bucket and guide. The same as with the shovel, the excavator has three buckets: for excavation of heavy earth (1 m³), medium earth (1.5 m³) and light earth (2 m³).

For operation as a dragline the shaft of the main winch has a hauling drum in place of the sprocket for the hoisting drum.

The conventional dragline boom is 15 meters long. With inserts of 5 and 10 meters length the boom can be increased to 20 or 25 meters in length provided that the capacity of the dragline bucket is decreased from 2 to 1 m³.

For work as a crane a 15-meter long latticework boom is used; it can be lengthened to 40 meters by inserts.

Using the E-2002 excavator as a base, the E-2006 excavator crane for erection work has been in production since 1957.

Power equipment. The E-2001 excavator is produced with a three-phase induction motor with phase rotor.

Besides the main electric motor the excavator has a three-phase AO-51/4 induction motor with a power of 4.5 kw and 1450 rpm for the compressor drive. It also has a three-phase MT-12 induction motor with phase rotor with a power of 3.5 kw and 900 rpm for opening the bottom of the bucket.

The E-2002 excavator has a diesel motor.

The excavator has pneumatic controls.

THE EKG-4 AND SE-3 EXCAVATORS, CRAWLER-MOUNTED, 3 and 4 m³ BUCKET CAPACITY

Purpose. The EKG-4 and SE-3 excavators are designed for excavation of rock, sand and gravel, for stripping and digging work in the coal industry, in open pit digging of ferrous and nonferrous minerals, in

quarries where building materials are being produced and for earth and rock work in the construction of large-scale industrial and hydraulic engineering projects.

The EKG-4 excavator is a modernized SE-3 excavator.

The operating equipment of these excavators consists of a shovel; this has a boom with thrust mechanism and a mechanism for opening the bottom of the bucket, a bucket handle and suspension unit for the boom.

The boom is of welded construction, of box-like cross section and made from carbon open-hearth steel.

The buckets, of 3 and 4 m³ capacity, have cast front and back walls. The front wall is cast from a special high-manganese steel; the rear wall -- from carbon steel.

The 5 m³ capacity bucket is of welded and cast construction, made from rolled sheet metal and castings.

The EKG-4 excavator is produced with a bucket capacity of 4 m³ and with crawler treads 900 mm wide.

On special order the excavator can be supplied with a bucket capacity of 5 m³ and with crawler treads 1,100 mm wide or with a bucket capacity of 3 m³ and crawler treads of 900 mm width.

The control of all operating mechanisms of the excavator is by electric switches without the use of friction clutches or brakes. They are controlled from the operator's cab situated in the right forward corner of the cab.

The control of the auxiliary mechanisms is by hydraulic and pneumatic apparatus.

THE EKG-8 EXCAVATOR, CRAWLER-MOUNTED, 6 AND 8 m³ BUCKET CAPACITY

Purpose. The EKG-8 excavator is a powerful crawler-mounted open-pit full-turning electric shovel. It is designed for the excavation and loading into transport vehicles of earth and minerals at open-cast mines of the mineral and coal industries; it is also used in pits for digging of construction materials and for handling earth and rock work on large-scale hydraulic-engineering projects when digging foundation pits and canals. The excavator has a bucket of 6 m³ capacity for heavy rock work. A bucket of 8 m³ can be used for light and medium earth.

Operating equipment. The EKG-8 excavator has one kind of operating equipment -- a shovel. The set of operating equipment includes a boom, bucket handle, bucket, thrust mechanism and mechanism for opening the bottom of the bucket.

Power equipment. The feeding of electrical power to the excavator is accomplished through a flexible hose-type high-voltage cable.

THE EVG-4 EXCAVATOR, CRAWLER-MOUNTED, 4 m³ BUCKET CAPACITY

Purpose. The EVG-4 excavator is a powerful electric full-turning shovel for stripping work; it has a crawler-type running gear. It is designed for excavation work and the unloading of minerals into transport vehicles on a higher level or the excavation of stripped rock material of different hardness and the unloading of same into a dump.

This excavator has a bucket of 5 m³ capacity for earth up to and including category IV. A bucket of 4 m³ capacity can be used for harder rock (up to category VII).

The base used for the EVG-4 excavator is the EKG-8 open pit excavator. The following are the same in both excavators: running gear, turntable and mechanisms, electrical equipment and several other units. The EVG-4 has an elongated boom and bucket handle, permitting a maximum unloading height of 16 meters. This excavator can load excavated rock into transport vehicles parked on a higher level. In this case the face can be as great as 10-11 m.

The operating equipment of the EVG-4 includes a boom, bucket handle, thrust mechanism and mechanism for opening the bottom of the bucket.

The main operations are electrically controlled by electric machine and magnetic amplifiers, while secondary operations are electrohydraulically and electropneumatically controlled.

THE EVG-6 EXCAVATOR, CRAWLER-MOUNTED, 6 m³ BUCKET CAPACITY

Purpose. The EVG-6 crawler-mounted excavator, exerting low specific pressure on the ground, is designed for the digging of coal. It can dig coal from a face up to 15-17 meters high or unload it into large-capacity transport vehicles. It can also be used for stripping work, for digging new pits and in open-pit mineral production. The EVG-6 excavator has a bucket capacity of 6 m³. An 8 m³ bucket can be used when excavating light and medium earth.

The turntable is fabricated from steel castings and rectangular welded sheets of metal. There are counterweight compartments at the rear of the turntable that can be loaded with up to 30 tons of ballast.

The turntable can be broken down into three parts when transporting the excavator by railway.

Operating equipment. The EVG-6 excavator has a thrust mechanism of the cable type with one inner handle and there is a pressure winch on the turntable.

The boom consists of two hinged parts. The upper end of the lower part of the boom is connected by several rods with the upper part of the bipod support, forming a rigid triangle. At the point where the two parts of the boom are joined together there is a seated bearing. The upper part of the boom is supported by two pairs of cables running from the head of the boom to the upright supports.

The mechanism for opening the bottom of the bucket is similar to the corresponding mechanism in the SE-3.

Power equipment. The principal mechanisms of the EVG-6 excavator are driven by reversible electric motors, direct current, with reduced flywheel moment of the armature and independent excitation in the generator-motor system.

The control of the excavator's principal operations is electric; that of auxiliary operations is electropneumatic and electrohydraulic.

EGL-15 EXCAVATOR, CRAWLER-MOUNTED, 15 m³ BUCKET CAPACITY

Purpose. The EGL-15 excavator is an electric full-turning crawler-mounted shovel for use in stripping work. It is designed for use in the mining of minerals in open pits and can be used for the excavation of coal and ferrous and nonferrous minerals. It can also be used in the construction materials industry and for the digging of earth and rock on major construction projects.

The EGL-15 excavator can either pile the excavated material or load it into large-capacity transport vehicles (dump cars with a load capacity of 60-90 tons).

It is a unique machine, consisting of a turntable with mechanisms, undercarriage and operating equipment that differ greatly from the corresponding parts of ordinary single-bucket shovels.

Four double-track bogies, exerting low specific pressure on the ground, make up the undercarriage of this excavator. Each bogie is independently driven by a direct current electric motor. Besides the driving and idler wheels, each crawler unit has three lower and one upper track support rollers.

A turning mechanism enables the bogies of the excavator to be turned around a vertical axis while movement is in progress if it is necessary to change the direction of movement. The excavator is provided with two turning mechanisms: one for the front bogies and another for the rear ones. The turning mechanism has a hydraulic drive. The maximum angle the bogies can be turned to either side is 15° ; this means that the excavator can be turned in a minimum radius of 25 m.

Operating equipment. The excavator has one kind of operating equipment -- a shovel. This consists of a bucket handle, thrust rod, balance beam, boom with guy wires, bucket and mechanism for opening the bottom of the bucket.

Pneumatic control system. Hoisting, turning and the pressure mechanisms are controlled by pneumatic brakes; sound signals are also pneumatic. All brakes on the excavator are of the enclosed type. They are released by compressed air.

THE ESh-1 WALKING EXCAVATOR, 3.4 m^3 BUCKET CAPACITY

Purpose. The single-bucket walking excavator with dragline equipment is used for the excavation and movement of earth in categories I-IV during the construction of main-line canals and on hydraulic engineering construction projects.

The ESh-1 excavator is the first walking excavator with a medium-capacity bucket produced in the Soviet Union. While several dozen of these machines were in operation their deficiencies became apparent and the machine was therefore removed from production in 1951; it was replaced by a more modern machine -- the ESh-4/40 walking excavator.

THE ESh-4/40 EXCAVATOR, 4 m^3 BUCKET CAPACITY

Purpose. This single-bucket walking excavator, the ESh-4/40, with dragline equipment, is designed for the excavation and movement of earth of categories I-IV to dumps during the course of work on hydraulic engineering projects, for stripping and excavation work in the coal and minerals industry, and also when digging main-line canals in irrigation systems.

The small specific pressure it exerts on the ground during operation and travel and its high maneuverability make it possible to use this excavator on soft and swampy ground.

The 40-meter boom makes it possible to transport the excavated material up to 80 m from the point of excavation without using other forms of transport.

The following parts of the ESh-4/40 excavator differ from the ESh-1: the position of mechanisms on the turntable, the electrical layout for excavator control and the design of the principal electric motor and the electric motor for the turntable. Other changes include the suspension of the boom, the design of the friction brake unit of the main winch, the turning mechanism, the bucket and a number of other units and parts.

Operating equipment. The ESh-4/40 excavator has one kind of operating equipment -- a dragline. The boom is a three-dimensional truss of welded construction, consisting of lower and upper sections, interconnected by flanges, pins and bolts. The latticework boom is made of pipe.

Power equipment. The ESh-4/40 excavator is fed from an overhead network, three-phase current, at a tension of 6,000 volts.

The current is transmitted along a flexible KShE-6 cable with a 3 X 25 -- 10 mm² cross section through a ring current collector to a tripole load breaker and then to a power transformer.

Control is by means of the clutches and brakes of the main winch and also by several auxiliary pneumatic mechanisms.

THE ESh-6/60 EXCAVATOR, 6 m³ BUCKET CAPACITY

Purpose. The single-bucket ESh-6/60 excavator is designed, like the ESh-4/40, to transfer earth of categories I-IV into dumps during the course of construction on large-scale hydraulic engineering projects. It can also be used for stripping work in coal and mineral deposits. The ESh-6/60 excavator can be used for the excavation of large main-line canals for irrigation networks. The length of the excavator boom makes it possible to move earth for a distance of 110 meters from the point of excavation without an auxiliary means of conveyance. The extremely low specific pressure on the ground during operation and travel makes it possible to use the excavator on soft and swampy ground.

There is an overhead crane with a 10-ton load carrying capacity for servicing the mechanisms situated on the turntable, both during repairs

and while the excavator is in operation. The crane can be moved on a track running along the cab; it can also move outside the cab through a gate situated in the rear wall of the cab. The crane has a reach of 5.4 m., a lifting height of 6.5 m., and a load-lifting speed of 2.5 m/min. The crane can be moved 2 m beyond the rear wall of the cab.

Operating equipment. The operating equipment of this excavator includes a boom and suspension, a bucket with its attachments and controlling pulleys.

The boom is supported on a rigid plate-like base which holds the boom at an angle of 30° . In case of necessity, when the excavator is operating with the boom inclined at an angle of $25-35^{\circ}$, the boom can be suspended on a special pulley which is also used for raising and lowering the boom. The weight of the boom, supports and ladders is 36 tons.

Power equipment. The excavator receives its electric power from an overhead network, three-phase current, at a tension of 6,000 volts. The current is carried directly to a synchronous electric motor, 715 kw power, of a 4-unit transformer.

The driving and hoisting power comes from two electric motors, each with a power of 290 kw and 800 rpm. The forward travel mechanism is provided with a similar motor. A common generator serves the electric motors providing power for thrust and forward movement.

The power for the turntable is supplied by two electric motors, each of 100 kw and 730 rpm. The electric motors are fed direct current from individual generators with three excitation windings.

The auxiliary drives are equipped with induction motors with a short-circuited rotor; they are fed from a transformer with a power of 180 kilowatt-amperes, mounted on the excavator.

The excavator is equipped with an automatic device for computing the amount of earth excavated.

THE ESh-14/75 WALKING EXCAVATOR, 14 m³ BUCKET CAPACITY

Purpose. The walking excavator ESh-14/75 has one kind of operating equipment -- a dragline. It is designed for the excavation of earth up to and including category IV when doing stripping work in coal and mineral deposits and in the construction of the very largest hydraulic engineering projects. The presence of a boom 75 m long makes it possible for the excavator to remove earth for a distance of 150 m without need for other means of conveyance and also to build high embankments and dig deep canals.

An electrical overhead crane is mounted inside the excavator cab; it has a load-lifting capacity of 15 tons and services all the units situated within the cab. The crane can also move outside the excavator body on tracks that extend outside the cab.

To deliver loads of small weight into the body of the excavator there is a jib crane at the entrance door of the cab; it has a boom and electrically operated pulley with a load-lifting capacity of 3 tons.

Undercarriage. The ESh-14/75 is equipped with a hydraulic mechanism for "walking"; it provides a high degree of smoothness during the travel of the machine. The travel mechanism consists of two lifting cylinders and two auxiliary cylinders, and two supporting skis, suspended by hinge-like arrangements to the cylinders on both sides of the excavator.

The walking mechanism is controlled by a special electrohydraulic apparatus.

Operating equipment. The ESh-14/75 is produced with dragline equipment. The working equipment includes the following units: boom, sheaves, controlling pulleys, pulleys on the superstructure, hoisting, hauling and boom cables and bucket.

The boom is of the guy type; it consists of one vertical and two inclined guy trusses, having one common holding collar of tubular cross section. The boom has four bays. Of these one bay is rigid and the three others are guyed. The holding collar of the boom consists of a rolled steel tube with a diameter of 850 mm and a wall thickness of 10-16 mm.

Power equipment. There are 47 electric motors and generators on the excavator, serving as power equipment for the operation of all the principal and auxiliary mechanisms.

The drive for the main mechanisms for hoisting, hauling and turning is provided for by direct-current electric motors. The drive for the auxiliary mechanisms is provided for by alternating-current electric motors.

Electric power of 6,000 v is supplied to the excavator through a high-voltage cable with a cross section of 3 X 95 + 1 X 35 mm and then through a current-collecting and distributing apparatus it is fed to the synchronous electric motor of the transforming unit and to the two electric motors of the walking mechanism, the general supply transformer and the two transformers for illumination.

Control. The excavator has three kinds of control: electro-mechanical, electrohydraulic and electropneumatic.

The remote control activation of the alternating current induction motors of the pump apparatus of the walking mechanism is accomplished by a high voltage switch from the control panel in the operator's cab.

THE ESh-25/100 EXCAVATOR, 25 m³ BUCKET CAPACITY
(experimental model)

Purpose. The ESh-25/100 walking excavator, equipped with a dragline, is designed to accomplish stripping work on a large scale in coal and ore deposits and is also used in the construction of the largest hydraulic engineering projects. It can handle earth in categories I-IV inclusive. The earth can be dumped up to 190 meters from the point of excavation without the assistance of auxiliary conveyance equipment.

The turntable consists of several welded sections. The length of the turntable is 33.2 meters and the width is 20.3 meters. All of the principal mechanisms for the machine, operating equipment, under-carriage and cab are mounted on the turntable.

On the upper part of the body there is an auxiliary winch with a load-lifting capacity of 10 tons for lifting the hauling and hoisting cables when they are being changed and for raising the gate in the rear wall of the body.

The supporting frame is of welded construction and serves as the base for the entire machine; it has a diameter of 18 meters and a height of 1.6 meters. To this frame are attached the circular rail for the rollers, a roller circle consisting of conical rollers which turn between the circular rails when the turntable rotates, and a toothed rim consisting of eight individual sections. Along this toothed rim roll the driving gears of the four reducers of the turning mechanism which rotates the entire turning part of the excavator around a central shaft.

The excavator's supporting frame moves along the ground and transmits its weight thereto.

The walking mechanism operates hydraulically and consists of two lifting and two traction cylinders suspended in pairs to the supports to the excavator turntable; there are also two supporting shoes. Powerful lifting cylinders raise the entire excavator during the walking process. Each lifting cylinder is rigidly attached to an axle which rotates in a bearing fastened on the support.

The walking mechanism has push button controls. The skis are hollow girders 20 meters long and 3.5 meters wide.

Operating equipment. The boom of the ESh-25/100 excavator consists of one vertical and two inclined beams. The lower end of the boom has two cast feet, widely separated and supported in bearings.

Power equipment. The excavator has 80 electric motors and generators for supplying power to all its mechanisms.

There is brake control of the hoisting and hauling winches and of the reducing gears for the turning apparatus and pneumatic control of the clutches.

The cab, from which most excavator operations are controlled, is air-conditioned, is well insulated and has a full view of the work area. There is a control panel for work operations; it is situated within the cab. Behind the operator's seat there is a control panel for the walking mechanism; it has two television screens for observation of the walking process.

THE EM-182 EXCAVATOR

Purpose. The multibucket nonturning excavator EM-182 for lateral, upper and lower digging is designed primarily for working in open pits for the excavation of sand, gravel and clay.

The excavator can load earth into a narrow gauge railway car. Production of this machine has been discontinued and replaced by the excavator EM-201.

Power equipment. The EM-182 excavator has an alternating current electric motor, type AO-63, with a power of 10 kw.

The control of the excavator is by levers and is accomplished from the cab.

THE EM-201 EXCAVATOR

Purpose. The multibucket nonturning excavator EM-201 for lateral, upper and lower digging is designed for the same work as the EM-182.

It can work in earth of categories I-III inclusive and load into trucks and narrow-gauge railway cars.

In contrast to the EM-182 excavator, the EM-201 has individual drives for its mechanisms.

The EM-201 is designed for work in a network having a line voltage of 380 v but it can also be switched to a voltage of 220 v.

THE EM-302 EXCAVATOR

The EM-302 excavator is a railway-mounted multibucket nonturning excavator for upper and lower transverse digging; it has an electric multimotor drive.

Purpose. The EM-302 excavator is designed for the cleaning of banks of canals and maintenance of their depths and widths; it is also used for the excavation of construction materials in sand, gravel and clay pits. These excavators can be used for stripping work. The multibucket excavator can accomplish stripping work by both upper and lower digging by the parallel or fan method.

The excavator can work in earth of categories I-IV with removal of the material by a conveyor belt into a dump or into transport vehicles through the hopper that forms part of the excavator.

Hopper and conveyor. The E-302 excavator has two systems for transporting earth -- hopper or conveyor. The hopper is designed for the pouring of earth into vehicles -- railway cars or trucks. The conveyor is used when pouring earth into a dump. The hopper is mechanically closed by a gate by means of a worm reducer set on an intermediate shaft. The electric motor of the mechanism for closing the hopper is activated from the operator's cab.

Power equipment. The EM-302 excavator has electric power equipment. The current is received from an outside electrical net with a line voltage of 380 v. The excavator can also operate from a net with a line voltage of 220 v. In this case a small exchange of equipment should be made.

For supplying general illumination and light for repairs there is a stepdown transformer of 380/12 v.

The excavator is controlled by three levers situated in the operator's cab and from an electrical control panel.

THE ET-121 EXCAVATOR

Purpose. The ET-121 excavator is designed for the digging of trenches with a rectangular cross section for telephone, telegraph, power and electric lighting cables, pipelines of a small distribution network and trenches for the laying of continuous footings for small buildings.

The excavator can work in earth of categories I-III.

The ET-121 excavator is a machine of the suspension type built on the basis of the standard DT-54 agricultural tractor. In place of the cardan shaft between the motor and tractor transmission there is an intermediate reducing gear for the operating speeds. The suspension frame for the excavator is mounted on the tractor frame. The driving force for the work unit is furnished by the intermediate reducing gear through the chain triangle to the drive shaft.

The operating equipment of the ET-121 excavator consists of a ladder with one row of buckets and two bucket chains. The excavated earth is dumped by means of a single-unit belt conveyor. Dumping can be accomplished on the right or left side of the excavator as it moves along.

The principal cutting part of the buckets is the teeth. These are made from carbon steel; the cutting edges are plated with a hard alloy (stalinite) or with the manganese steel 13GL. The drive shaft for the bucket chain is situated in the upper part of the bucket frame. The sprockets on the drive shaft, seated on splines, support the bucket chains. The transmission for the belt conveyor is mounted on the drive shaft.

Power equipment. A 1-MA or D-54 motor is mounted on the ET-121 excavator.

The excavator is controlled by levers situated in the operator's cab.

THE ETN-122 EXCAVATOR

Purpose. The ETN-122* (*Manufactured and tested experimental models.) is built on the basis of the MTZ-2 "Belarus" tractor. It is designed for digging trenches of a depth of 1.2 meters and of a width of 0.2 or 0.4 meters in homogeneous stone-free earth of categories I-III. The machine can be used for the accomplishment of small-scale earth work where there is need for frequent self-propelled moves, especially for needs of public utilities work in towns and cities and in leveled areas. The machine can dig trenches alongside buildings 700-900 mm from their walls.

EXCAVATORS ETN-141 AND 142

Purpose. The trenching excavators ETN-141 and ETN-142 are designed for digging trenches with a rectangular cross section with a width of 0.43 meters for the laying of ceramic and other kinds of pipe, and also for laying drainage tile at a depth as great as 1.4 m with the slope in the bottom of the trench between 0.03 and 0.003.

These excavators are able to work in saturated unfrozen mineral earth (clay, clayey loam and sandy loam) in earth of categories I-III inclusive.

The ETN-142 trenching excavator is a self-propelled excavating machine, crawler mounted. It is based on the tractor D-54. To decrease the specific pressure on the ground the base of the tractor has been lengthened by 127 mm by means of a special insert in the frame. This provided additional suspension for the upper and lower track support rollers in the middle part of each crawler. For this purpose special shoes were attached to each tread of the tractor; this increased the width of the crawler tread to 690 mm.

The working part of the excavator consists of two bucket chains with buckets attached thereto. The frame is of welded construction. To the frame are attached the guide rollers, tension apparatus, cleaning board, drive shaft and scraper. The scraper force-cleans the buckets at the time they are unloaded.

The buckets are made from drop-forged metal to which the teeth are attached; the teeth accomplish the cutting of the earth.

The hydraulic system of the ETN-142 excavator is designed to accomplish the hoisting and lowering of the working mechanisms.

Electrical equipment. The excavator has a direct current generator with a voltage of 12 v and a storage battery feeding the lighting and signal equipment through a relay regulator.

THE ETN-251 EXCAVATOR

Purpose. The ETN-251 excavator is used for digging trenches with a rectangular cross section with vertical walls for the laying of water, gas and sewage pipes and also for digging trenches for continuous footings of buildings. The excavator can work in earth of categories I-III, provided it contains no stones.

Operating equipment. The operating equipment of this excavator is an endless ladder with buckets attached thereto. The bucket ladder is set on a special bucket frame consisting of two parts: the head, with brackets, supporting the drive shaft, and the lower-rear part, with supporting rollers, guide wheels and tension apparatus for the bucket chains.

Conveyor. The earth from the buckets, when these are overturned, falls on a traveling belt conveyor, constantly unloading the removed earth on either side of the trench. To clean the conveyor drums of the adhering soil there is a cleaning device situated within the conveyor frame.

The undercarriage consists of two bogies with crawlers, attached in hinge fashion to the main frame of the excavator through semi-axles which permit independent lifting of the bogies when obstacles are encountered under one of the treads.

Power equipment. The power apparatus in the first group of excavators produced was the 1-MA motor, while excavators produced at a later date carried a D-54 motor.

EXCAVATORS ETN-351 AND 352

Purpose. The ETN-351 and ETN-352 excavators are designed for digging trenches with a rectangular cross section with vertical walls for sewage or water systems and also for oil and gas pipelines in earth of categories I-III that is free of large stones.

The excavators ETN-351 and 352 are self-propelled machines, crawler-mounted. The DT-54 tractor serves as a base.

Operating equipment. The basic work unit of the ETN-351 excavator consists of a frame on which move two continuous ladders. With this kind of operating equipment the excavator digs trenches 800 and 1,100 mm wide.

When special working equipment -- three ladders -- the excavator can dig trenches 1500 and 1800 mm wide.

Conveyor. For dumping of excavated earth the ETN-351 and 352 excavators are equipped with conveyors by means of which the earth can be poured either to the left or to the right as the excavator moves along.

Power equipment. There is a D-54 motor in the forward part of the lower frame of the excavator. It has a disk friction clutch whose shaft is connected with the primary shaft of the transmission through a chain clutch.

THE ETU-353 EXCAVATOR

Purpose. The ETU-353 general purpose trench excavator was designed to dig trenches for the laying of water, gas and sewage pipes of various diameters and can also be used in the construction of irrigation networks and the digging of continuous footings for buildings.

The ETU-353 excavator uses the same worm reducer for hoisting and lowering the working equipment as does the ETN-251.

Alternate equipment can be attached to the working part of the excavator: type A --- for digging trenches with perpendicular walls with a depth of 3.5 meters and types B and C -- for digging trenches with step-like walls, with depths of 2.5 and 3.5 meters.

EXCAVATORS ER-2, ER-4, ER-5, AND ER-6

Purpose. Wheel-type trench excavators are designed for digging trenches for main-line pipelines of various diameters and for various purposes and also for laying power and communication lines.

Design. Wheel-type excavators are self-propelled excavators, continuous-action type, crawler-mounted. These machines consist of three main parts: a base, working equipment consisting of a rotating wheel with buckets and bucket teeth, and a belt conveyor situated on the inner part of the wheel. The hoisting and lowering of the forward part of the wheel is accomplished by a hydraulic hoisting mechanism.

The cleaning of the bottom of the trench is accomplished by a special scraper.

THE ER-4 EXCAVATOR

Purpose. The wheel-type excavator ER-4 is designed for digging trenches for main-line oil pipelines with a diameter up to 600 mm.

The excavator can handle earth in categories I-IV inclusive.

Description of design. The base of the excavator is the S-80 tractor. In order to get lower speeds a supplementary gear drive has been introduced into the tractor's transmission.

The working equipment consists of the following basic units: a working wheel (rotor), frame, drive shaft for the wheel, supporting rollers, guiding rollers, rear support, and conveyor.

The wheel consists of two steel wheels to whose circumference the buckets are attached. Cutting teeth are attached to each bucket. To the inner edges of the wheels, along their entire circumference, are attached racks by means of which rotary motion is transmitted to the wheel.

THE ER-5 EXCAVATOR

Purpose. The wheel-type excavator ER-5 is designed to dig trenches for main-line oil pipelines up to 1,000 mm in diameter. The excavator can handle earth in categories I-IV inclusive.

Description of design. The excavator consists of two units: a tractor and the work unit. The tractor moves on crawlers, using the undercarriage of the S-80 tractor with some modifications. In the forward part of the tractor there is a diesel-electric motor consisting of a 1D6 diesel with synchronous generator (alternating current). The frame of this tractor has been lengthened and rigidly connected with the crawler-type undercarriage. The treads have also been lengthened.

The work unit consists of the following parts: work wheel (rotor), reducing gear for the wheel drive, frame, conveyer, rear support and guiding and supporting rollers.

The wheel is designed for the direct digging of trenches and consists of three disks along whose rims there are 32 buckets in a staggered arrangement.

Hydraulic mechanism for hoisting and lowering the working equipment. The hoisting and lowering of the forward part of the working unit is accomplished by a hydraulic drive and chain drive.

THE ER-6 EXCAVATOR

Purpose. The ER-6 wheel-type excavator is designed for digging trenches for a cable network and for laying pipes with a diameter up to 400 mm.

This excavator can handle earth in categories I-IV inclusive.

Description of design. The base for this excavator is the crawler-mounted tractor DT-54.

As in the case of the excavators ER-4 and ER-5, the ER-6 consists of two parts: a tractor and attached working equipment.

The tractor has 10 working speeds and 6 travel speeds (5 forward and 1 reverse).

THE ETR-152 EXCAVATOR

Purpose. The ETR-152 trench excavator is designed for digging trenches with rectangular and trapezoidal cross sections in earth of categories I-III that is free of large stones, for laying telephone, telegraph, electric lighting and power cables and pipelines. The ETR-152 excavator can be used when building irrigation networks.

The ETR-152 is a self-propelled crawler-mounted machine. The tractor S-80 serves as a base. The S-80 has been modified in the following ways: the KDM-46 motor is turned 180° and is situated above the housing of the steering clutches. The semiframe for the crawlers has been made in sections and lengthened; one lower track roller has been added to each side for the purpose of increasing the supporting surface of the crawler track due to the great weight of the excavator in comparison with the tractor.

The working equipment consists of a wheel, frame, lateral cutters, blade drums, buckets, a drive shaft for the working equipment and supporting rollers.

The wheel consists of two disks to which 14 buckets are attached. On the end faces of these disks there is tothing which is at all times meshed with the gear wheels of the bucket wheel's drive shaft.

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